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FACTORS INFLUENCING TRAINABILITY IN THE MARINE CORPS

by

Sheldon E. Haber

Serial T-314
14 April 1975

The George Washington University
School of Engineering and Applied Science
Institute for Management Science and Engineering

Program in Logistics

Contract N00014-75-C-0729
Project NR 347 020
Office of Naval Research

NONE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER T-314	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* FACTORS INFLUENCING TRAINABILITY IN THE MARINE CORPS		5. TYPE OF REPORT & PERIOD COVERED SCIENTIFIC 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) SHELDON E. HABER		8. CONTRACT OR GRANT NUMBER(s) N00014-75-C-0729
9. PERFORMING ORGANIZATION NAME AND ADDRESS THE GEORGE WASHINGTON UNIVERSITY PROGRAM IN LOGISTICS WASHINGTON, D. C. 20037		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS OFFICE OF NAVAL RESEARCH CODE 430D ARLINGTON. VIRGINIA 22217		12. REPORT DATE 14 April 1975 13. NUMBER OF PAGES 21
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* NONE 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

DISTRIBUTION OF THIS REPORT IS UNLIMITED.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

MILITARY MANPOWER ANALYSIS
OCCUPATIONAL ASSIGNMENT
TRAINABILITY OF RECRUITS
CONTINGENCY TABLE ANALYSIS

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The findings of this paper confirm those of an earlier study, namely, that educational attainment is a better predictor than mental ability in forecasting job performance. In this paper job performance is measured in terms of trainability, in contrast to the earlier paper where job performance was measured in terms of attrition. These findings have important implications for the procurement of enlisted personnel, and their assignment to military occupations after passing initial boot camp training.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

NONE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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The findings of this paper confirm those of an earlier study, namely, that educational attainment is a better predictor than mental ability in forecasting job performance. In this paper job performance is measured in terms of trainability, in contrast to the earlier paper where job performance was measured in terms of attrition. These findings have important implications for the procurement of enlisted personnel, and their assignment to military occupations after passing initial boot camp training.

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FACTORS INFLUENCING TRAINABILITY IN THE MARINE CORPS

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0. Introduction

In a study of attrition among first-term enlistees in the Marine Corps [3], it was found that completion of high school was a better predictor of turnover than the score achieved on the General Technical Test (GT). In this paper we focus on another aspect of job performance, i.e., the productivity of enlistees who remain in the Marine Corps for the duration of their service contract. Again it is found that educational attainment is a better predictor of performance than mental test score. These findings have implications for the kind of personnel that the service should be seeking to enlist and for the criteria to be used in assigning individuals to military occupations, given that they have been accepted into the military.

Although a large literature exists on the use of educational standards as a device for screening job applicants (see [1]), little is known about the relationship of education or test scores (which generally attempt to measure intelligence) to job performance in particular occupational contexts. Perhaps the most relevant to this inquiry is a recent Rand study [2] which indicates that college trained individuals performed their duties as policemen -- in terms of civil service promotion, number of civilian complaints, and charges of misconduct -- better than non-college

trained individuals. The context of our study is similar but not the same. Job performance in the military typically is not dependent on passing of formal tests and relatively few enlisted personnel have college training. Yet the question still remains as to whether job performance in the military is related to educational attainment, in particular, completion of high school, or mental ability as determined from tests that attempt to measure innate intelligence.

The measurement of job performance is not easy even when the result of work activity is a tangible output. When tangible output is lacking, as when a service is rendered, the measurement process becomes even more difficult. This is the typical case in assessing the performance of military personnel. In the absence of a tangible output, job performance must be measured in terms of proxy variables. One proxy is retainability. To the extent that an individual is absent from a job, either by choice or because he was judged to be unqualified, there can be no output, tangible or intangible. In this sense, attrition, which is an indicant of non-production of output, is a negative measure of job performance.

Positive measures of job performance are also required. Under competitive conditions, the best positive measure of productivity is the wage rate. It is a moot question as to whether military labor markets are competitive. However, it is reasonable to assume that the process of selecting individuals for promotion is not random, and that ability to perform specified tasks, to provide leadership, and to maintain a high standard of personal conduct are primary considerations in determining if an individual is to be advanced in rank. Although these qualities are not synonymous with trainability, it is likely that they are highly correlated with it, and that promotion is intrinsically related to how well one performs the duties for which he has been trained. On the basis of this assumption, trainability is measured by whether or not a given rank is attained by individuals who complete their service obligation. The specification limiting the sample to individuals who have completed their service contract is an important one since rank

attainment is a time dependent variable. By restricting the sample in this manner, the retainability aspect of job performance is held constant. In this paper, we define completion of one's service contract as serving between 0 and 3 months less than the period contracted for. Thus, individuals who served between 22-24, 34-36, and 46-48 months of a two-year, three-year, and four-year enlistment contract, respectively, are defined as having completed their service obligation.

The current practice in the Marine Corps is to focus on intelligence test scores in enlisting individuals and in assigning them to an occupation. This is in contrast to the finding noted earlier, i.e., that educational attainment is the better predictor of the retainability aspect of performance. It is possible, of course, that although perseverance through completion of high school is highly related to completing one's service obligation, it may be unrelated to the trainability aspect of job performance. The objective of this paper is to examine the factors influencing this latter aspect of job performance using the methodology of contingency table analysis.[1]

1. The Data Base and the Variables Included in the Analysis

The data base is a longitudinal personnel history file developed by the Marine Corps. Hereafter it is referred to as the cohort file. The file contains significant historical information for first-term enlistees by date of entrance into the Marine Corps. The complete file contains information for over 700 thousand first-term enlistees who entered the Marine Corps between calendar years 1962 and 1972. The cohort of enlistees entering the Marine Corps in 1968 was chosen for intensive study, as this was the latest cohort for four-year enlistees. The 1970 cohort of enlistees was also examined to see whether the findings for a more recent year were consistent with those for the earlier period.

The predictor variables selected for inclusion in the contingency table model are shown in Table 1. Each of the variables is discrete and

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[1]The reader is referred to [3] for a detailed discussion of the contingency table model.

for this reason alone the contingency table analysis is particularly appropriate. The variables age at enlistment, length of enlistment, and level of education are self-explanatory. Three of the variables, however, require further description.

Table 1

Predictor Variables Used in the Analysis

	Number of Categories	Categories
Age at Enlistment (A)	3	17; 18 or 19; 20 or more
Combat Experience (C)	2	Served in Vietnam; did not serve in Vietnam
Education (U)	2	Less than high school; high school and above
Length of Enlistment (L)	3	Two; three; four or six years
Mental Group (G) a/	3	I or II; III; IV or V
Military Occupation (O)	4	Ground combat; general repair; clerical and semi-skilled; other skills

a/ As measured by the General Technical Test.

Mental group is a proxy for general intelligence and is measured by the grade received on the General Technical (GT) Test. This test which consists of arithmetic and verbal questions, is given to an enlistee after he has been accepted into the Marine Corps. Since individuals are assigned to an occupation on the basis of GT score, it is employed in the analysis rather than the Armed Forces Qualification Test (AFQT).[2]

[2]The AFQT, which is given to enlistees prior to enlistment, is another means of classifying enlistees by mental group. In addition to arithmetic and verbal questions, the AFQT tests tool knowledge and pattern recognition. As a result, the AFQT and GT measure different facets of intelligence which are not necessarily correlated with each other.

Four military occupational areas are distinguished to account for differences in promotion policy among occupations. For example, one might expect that the ratio of qualified personnel to job positions is smallest in the repair occupations, and that promotion would be more rapid for individuals trained in this area so as to increase the probability of their reenlisting. Promotion due to supply-demand relationships is different from promotion reflecting labor quality. Classifying individuals by military occupation permits measurement of the factors associated with labor quality.

The military occupations are grouped as follows: Ground combat includes the infantry, artillery, and tank specialties; general repair refers to such occupations as electricians and plumbers, aircraft maintenance, and telecommunications repair; the clerical and semi-skilled occupations include personnel administration, supply, food service, and motor transport excluding repairmen or mechanics; such diverse occupations as photography, printing, mapmaking, and music comprise the "other skill" group.

It should be noted that the occupational field refers to an individual's primary occupational specialty which may be different from his job at any particular moment of time. Of primary importance, although an individual's primary occupational specialty is assigned after boot camp, the information is not entered into the cohort file until his enlistment terminates. Therefore, the information does not indicate whether or not occupational training was successfully completed. Hence, when occupational field is used as a predictor variable, it represents the type of training received rather than the difficulty of becoming qualified in a skill area.

The combat variable is also included in the analysis to account for advances in rank made under combat conditions to fill voids in the chain of command, and to account for the possible negative effects of combat on individual performance. The designation "combat" means that an individual served in Vietnam; it does not mean that he necessarily engaged in combat.

2. Applications of the Contingency Table Model

Before discussing the substantive findings of the study and the policy implications that may be drawn from these findings, it will be useful first to define job performance in greater detail, and then to provide some summary quantitative measures of the impact of the variables examined on job performance. For two-year enlistees, above average job performance is defined as promotion to E-4 or higher; for four-year enlistees, it is defined as promotion to E-5 or higher.[3] Promotion to these ranks indicates high labor quality; failure to be promoted to these ranks is taken to indicate lower labor quality.

The applications of the model, the number of observations entering into each application, and the percentage of variation in promotion explained by each model, denoted by I^*, is presented in Table 2. As can be seen, uniformly high values of I^* were obtained in all applications of the contingency table technique. This was achieved by examining the main or direct effects and the more important first order effects; parameters measuring less important first order effects and all higher order effects were not included in the models.

The first application of the contingency table technique was to assess the impact of the variables in Table 1 on promotion of two-year enlistees who entered the Marine Corps in 1968, and who completed their service contract. The probabilities of being promoted to E-4 or higher[4] for this group are shown in Table 3. To illustrate the inter-

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[3]The probability of being promoted to E-4 or higher during a two-year enlistment was .51 in 1968, and .39 in 1970. The probability of being promoted to E-5 or higher during a four-year enlistment was .48 in 1968. An alternative measure of rapid promotion, i.e., promotion to E-5 or higher for two-year enlistees is also utilized. The criterion of promotion to E-6 for four-year enlistees could not be used since only a handful of Marines attained this rank.

[4]Hereafter referred to as "promotion to E-4" for simplicity.

pretation to be given to these figures, when other factors such as level of education, mental group, race, etc. are held constant, the probability of being promoted to E-4 is .44 for individuals aged 17 years old at enlistment, but it is substantially higher, .57, for individuals who enlisted at age 20 or older. Thus, it appears that age contributes in a positive manner to trainability.

The range in promotion probabilities can be used to measure the impact of a variable on job performance. In the discussion that follows, variables are grouped into three categories: important, low importance, and not important depending on whether the range in the promotion probabilities between levels of the predictor variable is in the neighborhood of 15, 5, or 0 percentage points, respectively. It is recognized that this characterization is a gross one as the range in promotion probabilities depends on the manner in which a variable is measured. For example, the range in promotion probabilities for the mental group variable would be greater if five classes had been used instead of three. Nonetheless, the measurement groupings utilized seem reasonable in light of conventional usage in delineating individuals by characteristic.

On the basis of the convention just noted, education ranks as the most important predictor of trainability; age, mental ability, and occupation are of some importance; and combat experience and race are of lesser importance (see Table 7). Thus, although mental ability is a better predictor of trainability, given that an individual remains on the job, than it is of attrition (see [3]), it is a poorer predictor than educational attainment in both aspects of job performance. The basis of this conclusion are the data in Tables 3-6. Tables 3 and 4 pertain to two-year and four-year enlistees in 1968 who attained the rank of E-4 and E-5, respectively. Table 6 is similar to Table 3 except that high rank is defined as E-5 rather than E-4. Table 5 is similar to Table 3 except it is for a later cohort, the cohort of two-year enlistees who entered in 1970.

Table 2

Applications of the Contingency Table Model

Application No. [a]	Population	Criterion of Performance	Population Size	Percentage Variation Explained by Model, I*
1	Two-year entrants into the Marine Corps in 1968 who completed their initial service contract	Promoted to E-4	12,422	84.9
2	Four-year entrants into the Marine Corps in 1968 who completed their initial service contract	Promoted to E-5	10,068	85.6
3	Two-year entrants into the Marine Corps in 1968 who completed their initial service contract	Promoted to E-5	12,422	77.6
4	Two-year entrants into the Marine Corps in 1970 who completed their initial service contract	Promoted to E-4	7,820	83.3

[a] See Table 7 for the variables included in each model application.

From Tables 3-6 it is possible to make sixteen comparisons between high school graduates in Mental Group III and non-high school graduates in Mental Group I or II with respect to the probability of reaching high rank. In all but three cases (one of which was a tie), the probability was higher for the high school graduate group. Likewise, in all but three cases (one of which was a tie), the probability of a high school graduate in Mental Group IV or V attaining high rank was higher than that of a non-high school graduate in Mental Group III. Even when comparing high school graduates in Mental Group IV or V with non-high school graduates in Mental Group I or II, the high school graduate group appears to perform better on the job when such factors as age, race, and combat experience are taken into account. In only two situations does it appear that non-high school graduates in Mental Group I or II perform better than high school graduates in Mental Group IV or V. The first occurs in the repair skills. The second occurs when high rank is defined as E-5 for two-year enlistees.[5]

Further examination of Tables 3-6 reveals that combat impacted on attainment of rank E-4 among two-year enlistees who entered the Marine Corps in 1968. Even though the impact of combat experience could have been positive or negative, the negative aspects predominated. Especially among high school graduates, combat experience appears to have reduced incentives to be promoted. This does not necessarily mean that high school graduates fought less well than non-high school graduates; it may simply indicate a reluctance to seek the responsibilities of leadership that are associated with rank in a combat environment. By 1970, when the Vietnam War was drawing to a close, the combat variable played only a minimal role on rank attainment. Of interest, four-year enlistees in 1968 were promoted at the same rate whether they served in Vietnam or elsewhere. Apparently, the possibility of serving in Vietnam was not viewed as a disincentive to promotion by this group which enlisted for the maximum enlistment period.

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[5]The percentage of two-year enlistees who attain this very high rank during the intial enlistment period is very small, however.

Table 3

Probability of Attaining Rank E-4: Two-Year Enlistees, 1968 Cohort [a]

		Probability of Attaining Rank E-4	
Age:	17 years	.44	
	18-19 years	.51	
	20 years and over	.57	
Race:	White	.55	
	Non-white	.47	
		Level of Education	
Combat Experience:		Less than H.S.	H.S. or above
Served in Vietnam			
	Mental Groups I and II [b]	.45	.64
	Mental Group III	.35	.52
	Mental Groups IV and V	.30	.42
Did not serve in Vietnam			
	Mental Groups I and II	.56	.77
	Mental Group III	.43	.65
	Mental Groups IV and V	.39	.58
Military Occupation:			
Ground Combat			
	Mental Groups I and II	.46	.66
	Mental Group III	.38	.57
	Mental Groups IV and V	.33	.51
General Repair			
	Mental Groups I and II	.55	.70
	Mental Group III	.40	.54
	Mental Groups IV and V	.32	.42
Clerical and Semi-skilled			
	Mental Groups I and II	.52	.74
	Mental Group III	.40	.63
	Mental Groups IV and V	.35	.54
Other Skills			
	Mental Groups I and II	.50	.72
	Mental Group III	.37	.60
	Mental Groups IV and V	.33	.52

a/ The overall probability of attaining Rank E-4 is .51.

b/ Based on the General Classification Test.

Table 4

Probability of Attaining Rank E-5: Four-Year Enlistees, 1968 Cohort [a]

		Probability of Attaining Rank E-5	
Age:	17 years	.37	
	18-19 years	.50	
	20 years and over	.58	
Race:	White	.51	
	Non-white	.45	
Combat Experience [b]			
		Level of Education:	
Military Occupation:		Less than H.S.	H.S. or above
Ground Combat			
	Mental Groups I and II [c]	.41	.58
	Mental Group III	.34	.48
	Mental Groups IV and V	.29	.47
General Repair			
	Mental Groups I and II	.49	.61
	Mental Group III	.46	.55
	Mental Groups IV and V	.30	.42
Clerical and Semi-skilled			
	Mental Groups I and II	.51	.73
	Mental Group III	.37	.56
	Mental Groups IV and V	.37	.62
Other Skills			
	Mental Groups I and II	.44	.60
	Mental Group III	.42	.54
	Mental Groups IV and V	.38	.54

a/ The overall probability of attaining Rank E-5 is .48.

b/ Approximately the same as the overall probability of attaining Rank E-4.

c/ Based on the General Classification Test.

Table 5

Probability of Attaining Rank E-5: Two-Year Enlistees, 1968 Cohort [a]

		Probability of Attaining Rank E-5	
Age:	17 years	.04	
	18-19 years	.06	
	20 years and over	.07	
Race:	White	.06	
	Non-white	.06	
		Level of Education:	
Combat Experience:		Less than H.S.	H.S. or above
Served in Vietnam			
	Mental Groups I and II [b]	.06	.11
	Mental Group III	.03	.06
	Mental Groups IV and V	.02	.03
Did not serve in Vietnam			
	Mental Groups I and II	.10	.21
	Mental Group III	.05	.11
	Mental Groups IV and V	.03	.06
Military Occupation:			
Ground Combat			
	Mental Groups I and II	.08	.16
	Mental Group III	.05	.10
	Mental Groups IV and V	.04	.08
General Repair			
	Mental Groups I and II	.07	.11
	Mental Group III	.04	.06
	Mental Groups IV and V	.01	.02
Clerical and Semi-skilled			
	Mental Groups I and II	.08	.19
	Mental Group III	.04	.08
	Mental Groups IV and V	.02	.05
Other Skills			
	Mental Groups I and II	.07	.14
	Mental Group III	.04	.08
	Mental Groups IV and V	.02	.04

a/ The overall probability of attaining Rank E-5 is .06.

b/ Based on the General Classification Test.

Table 6

Probability of Attaining Rank E-4: Two-Year Enlistees, 1970 Cohort [a]

		Probability of Attaining Rank E-4	
Age:	17 years	.32	
	18-19 years	.39	
	20 years and over	.48	
Race:	White	.43	
	Non-white	.36	
Combat Experience		[b]	
		Level of Education:	
Military Occupation:		Less than H.S.	H.S. or above
Ground Combat			
	Mental Groups I and II	.25	.48
	Mental Group III	.19	.37
	Mental Groups IV and V	.16	.27
General Repair			
	Mental Groups I and II	.33	.64
	Mental Group III	.27	.56
	Mental Groups IV and V	.26	.49
Clerical and Semi-skilled			
	Mental Groups I and II	.53	.71
	Mental Group III	.34	.52
	Mental Groups IV and V	.36	.48
Other Skills			
	Mental Groups I and II	.36	.64
	Mental Group III	.33	.50
	Mental Groups IV and V	.26	.45

a/ The overall probability of attaining Rank E-4 is .39.

b/ Approximately the same as the overall probability of attaining Rank E-4.

c/ Based on the General Classification Test.

Table 7

Summary of Findings [a]

Application No.	Population	Criterion of Retention	Importance of Predictor Variable [b]					
			Age	Race	Education	Mental Group	Occupation	Combat
1	Two-year enlistees, 1968	Attained rank of E-4	L	L	I	L-I	L	L-I
2	Four-year enlistees, 1968	Attained rank of E-5	L	U	L	L	L	L
3	Two-year enlistees, 1968	Attained rank of E-5	I	L	I	I	L-I	U
4	Two-year enlistees, 1970	Attained rank of E-4	I	L	I	L-I	I	U

a/ In all applications of the model, the sample is restricted to individuals completing their initial service contract.

b/ I denotes that the variable is important; L denotes the variable is of low importance; and U means that the variable is unimportant.

The probability of attaining high rank also varied by occupational area. Surprisingly, however, the highest probabilities are found in the clerical and semi-skilled occupations rather than in the repair occupations where the cost of training to the Marine Corps is highest. Of the four occupational groupings, the GT test had the highest predictive capability in the repair occupations. Among two-year enlistees, it was a somewhat better predictor than educational attainment, among four-year enlistees, the reverse was true.

In addition to providing a basis for evaluating the relative importance of a large number of predictor variables on trainability, the contingency table analysis permits one to estimate the probability of an individual with given characteristics attaining a high rank. As an example, we show this probability for individuals A and B with the characteristics shown below:

	A	B
Age at Enlistment	17 years	20 years or more
Education	Less than high school	High school or above
Length of Enlistment	4 years	4 years
Mental Group	I or II	III
Military Occupation	Repair	Repair
Race	White	White
Probability of Attaining Rank E-5	.41	.67

As can be seen, the probability of attaining high rank can vary widely among individuals. The large differential seen here is explained by the inclusion of the age factor in the calculation. Since high school graduates are generally older than non-high school graduates, the probability of above rank attainment for the former group will be larger than the estimates shown in the previous tables where age was held constant. As indicated by the analysis, however, the primary factor accounting for the wide differentials is educational attainment.

3. Conclusions

The findings of this paper confirm those of the earlier paper, namely, that educational attainment is a better predictor than mental ability in forecasting job performance. In this paper job performance is measured by rank attainment among individuals who completed their service obligation, in contrast to the earlier paper where job performance was measured in terms of attrition. Although rank attainment measures a number of qualities, it is assumed that it is closely related to how well an individual performs the duties for which he has been trained, i.e., that rank attainment measures trainability. It should be noted that the way the occupational information is entered in the data base upon which the study draws, it is not possible to infer the relationship between educational attainment (or mental ability) and ability to pass training courses. What is measured, however, is how that training is utilized. The major finding of the study is that when an individual is placed in a primary occupation, his performance in that occupation is related more to his educational attainment than his test score on the General Technical (GT) Test.

In reaching this conclusion, several reservations need to be borne in mind. First, it is not clear that the test now used by the military to measure mental ability is a good test for this purpose. Second, above average performance may be measured in a number of ways other than the ones utilized here. For example, in specific occupations where a tangible output is produced, it may be possible to obtain explicit measures of productivity. Finally, the time horizon for measuring job performance has been restricted to the initial enlistment period; for some purposes this may be too short a time period for measuring training effects.

Since the findings of this study are similar to the earlier one, the policy conclusions are also similar, namely, more emphasis should be given to enlisting high school graduates. In addition, age, which often implies additional work experience, should be taken into account in assigning individuals to military occupations.

Given the current procedure in the Marine Corps of assigning individuals solely on the basis of the GT test, it may not be easy to implement these recommendations. The data of this and the earlier study indicate, however, that such modification would result in improved manpower utilization.

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AD-A008 178/6GI

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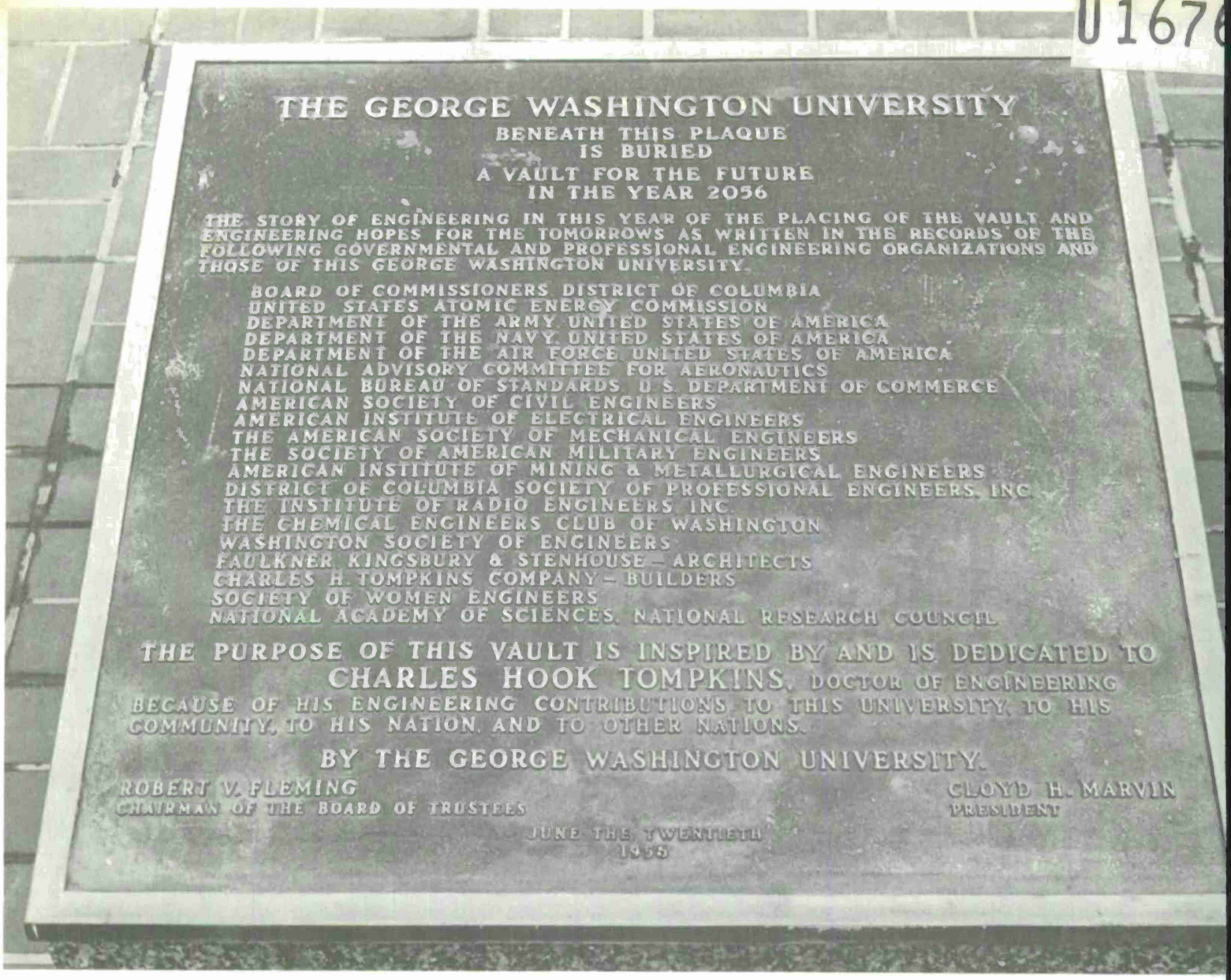

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